Derive Uniform Acceleration Equations
- only valid if the acceleration is uniform

definition:

Acceleration, a - rate of change in velocity

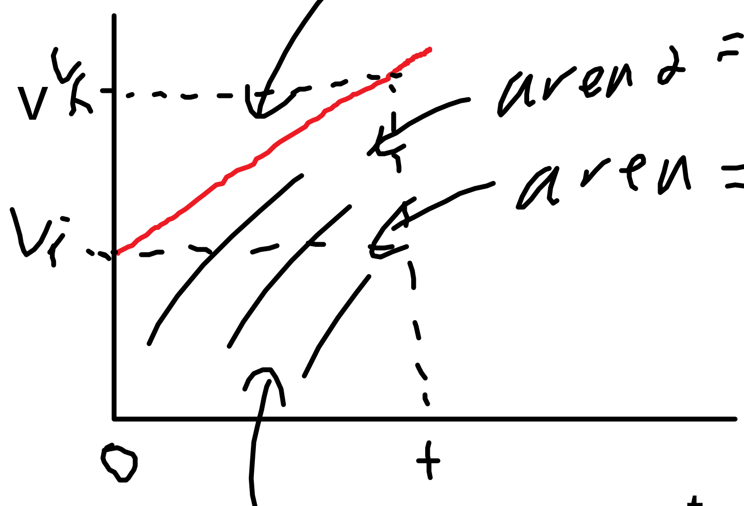
$a=\Delta v/\Delta t$ = slope of the v-t graph

$a=(v_f-v_i)/t$ or $at = v_f-v_i$

$v_f=at+v_i$

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{v_f - v_i}{t} = a$$

graph:



$$\text{area 2} = \frac{v_f - v_i}{2}\, t$$

area = displacement, d

$$\text{area 1} = v_i \times t$$

total area

$$= v_i t + \left(\frac{v_f - v_i}{2}\, t\right)$$

$$= v_i t + \frac{1}{2} v_f t - \frac{1}{2} v_i t$$

$$= \frac{1}{2} v_i t + \frac{1}{2} v_f t$$

$$= \frac{1}{2}(v_i + v_f)\, t$$

$d = 1/2\,(v_i + v_f)t$

eg. A car is moving at 10.0m/s and accelerates uniformly to 16.0 m/s over 3.0 s. After 3.0s it slows uniformly to 8.0 m/s over 4.0 more seconds.

a) determine the acceleration when it is speeding up and slowing down.
b) determine the displacement of the car.
c) graph d-t, v-t

Q9-12 and 13-16 pages 69-72
lab next class - read labbook p22-23
prepare a data table

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a) determine the acceleration when it is speeding up and slowing down.

$$\frac{16\,m/s - 10\,m/s}{3.0\,s} = 2.0\,m/s^2$$

$$\frac{8.0\,m/s - 16.0\,m/s}{4.0\,s} = -2.0\,m/s^2$$

* average acceleration: total change in velocity/total time

$a = (8-10)/7 = -0.2857 = -0.29 m/s^2$

a) determine the displacement of the car.

$d = 1/2(v_i+v_f)t = 0.5x(10+16)x3 = 39$ m

0.5x(16+8)x4=48 m

total d = 39+48=87 m

average velocity? total d/total time

$v_{avg} = 87/7 = 12.4286 = 12 m/s$

a) graph d-t, v-t

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